

Omar Alhussein

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Education

- Jan2016 - Apr2020 **PhD in Communications and Information Systems (Electrical and Computer Engineering),**
University of Waterloo, ON, Canada
Thesis: On the Orchestration and Provisioning of NFV-enabled Multicast Services
Advised by: Weihua Zhuang
GPA: 89/100
Notable courses: Stochastic processes, Intro to optimization, Wireless commun. networks.
- May2014 - Aug2015 **MASc in Engineering Science,**
Simon Fraser University, BC, Canada
Thesis: Performance Analysis of Wireless Fading Channels: A Unified Approach
Advised by: Jie Liang, and Sami Muhaidat
GPA: 4.22/4.33
Notable courses: Machine learning, Linear systems theory, Advanced digital communications.
- Sep2008 - Aug2013 **BSc in Telecommunication Engineering,**
Khalifa University, Abu Dhabi, United Arab Emirates
GPA: 3.53/4.0 .

Research Interests

Networking and AI, mobile edge computing, next-generation networks, wireless communications.

Work Experience

Research

- Jun2020 - present **Senior Research Engineer, Advanced Networking, Huawei Technologies Canada**, Ottawa, Canada.
 - Researching native machine learning-based solutions for traffic engineering and network operations.
 - Collaborating with academic teams on research projects.
 - Filed three patents on probabilistic and distributed AI for networking, and AI trustworthiness.
 - Received outstanding individual award for the year 2021.
 - Received technology spotlight award in April 2021.
 - Received Ottawa wireless department spotlight award in August 2021.
- Jan2016 - Apr2020 **Doctoral Research, University of Waterloo**, Waterloo, Canada.
 - Developed a model-free data-driven method, using deep reinforcement learning, to compose and orchestrate abstract network services with time-varying traffic requirements onto the network substrate. A main result is using model-based solution with a vanilla DRL aids in the exploration process especially in conflicting and sparse reward environments.
 - Developed an online competitive algorithm for multicast services with mandatory and best-effort NFs. The algorithm is designed using a primal-dual based approach, and it offers generalized and alternative description to existing relevant works. Results published in IEEE JSAC.
 - Formulated an optimal joint traffic routing and NF placement for multicast services. Developed heuristic algorithm to decrease the complexity of the NP-hard problem. Published in IEEE JSAC and Globecom.
 - Link to thesis: <http://hdl.handle.net/10012/15850>
- May2014 - Aug2015 **MASc Research, Simon Fraser University**, Vancouver, Canada.
 - Adopted two tractable mixture distributions, namely mixture of Gaussian and mixture of Gamma, to approximate various (composite) fading channels using the expectation-maximization and variational Bayes algorithms.
 - Conducted performance analyses over various composite fading channels (using the mixture distributions) in several environments, such as cognitive radio networks, and impulsive noise environments.
 - Results were published in seven conf/journal papers.
 - Link to thesis: <http://summit.sfu.ca/item/15696>

- Dec2013 - May2014 **Research Assistant**, *Etisalat British Telecom Innovation Centre*, Abu Dhabi.
 o Developed a data reduction pre-processing technique for large datasets to be used in machine learning classifiers. Several papers were published. Was advised by Paul. D. Yoo & Kin Poon.
- Teaching**
- Jan2018 - May2019 **Graduate Teacher Assistant**, *University of Waterloo*,
 Digital communications (ECE 318), and Communication networks (ECE 358).
- Jan2015 - May2015 **Graduate Teacher Assistant**, *Simon Fraser University*,
 Introduction to engineering analysis (ENSC 180), and linear systems (ENSC 380).
- Jan2010 - May2012 **Science Communicator (part-time)**, *Khalifa University Intel Discovery Center*, Abu Dhabi.
 Presented computing and communication technologies to stimulate/inspire school kids.
- May2009 - Jun2009 **Teacher assistant and supervisor**, *Institute of Applied Technology*, Abu Dhabi.
 Served as a teacher assistant and supervisor in a summer school for primary school students.
- Other**
- Jun2012 - Nov2012 **Internship**, *ELKO TGS*, Ankara, Turkey.
 Involved in the design/analysis of circuit breakers, various electrical tests, and studying feasibility of initiating SCADA communication system for the company. Tasks included optimizing company's network and its security.
- Jan2010 - May2013 **Supervisor/invigilator (part-time)**, *IETLS Outreach Centre, British Council*, UAE.
 Participated in a mobile team to carry IELTS examinations in different places. Started off as a marshal and was promoted to invigilator and then supervisor in very short-time.

Current Supervision

- Sep 2021 - present Zaid Almahmoud, [Deep Learning based Reconnaissance Techniques for Cyber Events](#), persuing Ph.D. at Birkbeck College, University of London. Co-supervision with Paul D. Yoo.

Patents

- networking, distributed ML **O. Alhussein**, [Architecture and method for network operations using distributed encoder-decoder structures](#), *filing process*.
- networking, Bayesian DL **O. Alhussein**, and A. Akhavain, [Traffic engineering framework guided by model uncertainty](#), *filing process*.
- DRL, AI Trustworthiness **O. Alhussein**, and P. Ashwood-smith, [Protection of DRL agents from theft with secret operational keys](#), *filing process*.

Manuscripts under review or preparation

- Traffic engineering, Bayesian DL **O. Alhussein**, and A. Akhavain, [Traffic Engineering with Epistemic Uncertainty](#), *under preparation*.
- AI trustworthiness **O. Alhussein**, and P. Ashwood-Smith, [Use of hidden patterns to protect deep reinforcement learning agents from theft](#), *under preparation*.

Peer-reviewed Publications

- NFV, DRL **O. Alhussein**, and W. Zhuang, ["Dynamic Topology Design of NFV-enabled Services using deep Reinforcement learning"](#), IEEE Transactions on Cognitive Communications and Networking, to appear. DOI: 10.1109/TCCN.2021.3139632
- NOMA, full-duplex M. Li, S. Huang, L. Tian, **O. Alhussein** and S. Muhaidat, ["Error rate performance of NOMA system with full-duplex cooperative relaying"](#), Physical Comm., pp. 1-1, 2021.
- trust management, IoT M. Ben-Yahya, **O. Alhussein**, and X. Shen, ["Securing software-defined WSNs Communication via trust Management"](#), IEEE Internet of Things J., pp. 1-1, 2021.
- NFV, competitive analysis **O. Alhussein**, and W. Zhuang, ["Robust online composition, routing and NF placement for NFV-enabled services"](#), IEEE J. Sel. Areas Commun., vol. 38, no. 6, pp. 1089-1101, 2020.
- NFV, multicast routing **O. Alhussein**, P. T. Do, J. Li, W. Shi, W. Zhuang, and X. Shen, ["A Virtual network customization framework for multicast services in NFV-Enabled core networks"](#), IEEE J. Sel. Areas Commun., vol. 38, no. 6, pp. 1025-1039, 2020.

- ML, subsampling **O. Alhussein**, P. D. Yoo, S. Muhaidat, J. Liang, "Efficient subsampling framework of very large datasets in machine learning," in Proc. IEEE CCECE, 2019, pp. 1-6.
- wireless, fading, spectrum sensing M. Li, **O. Alhussein**, P. Sofotasios, S. Muhaidat, P. D. Yoo, J. Liang, and A. Wang, "Sensor-based cooperative multi-antenna spectrum sensing with imperfect reporting channels," IEEE Trans. Sustainable Comput., vol. 05, no. 01, pp. 48-60, 2019.
- NFV, multicast routing **O. Alhussein**, P. T. Do, J. Li, Q. Ye, W. Shi, W. Zhuang, X. Shen, X. Li, and J. Rao "Joint VNF placement and multicast traffic routing in 5G core networks," in Proc. IEEE GLOBECOM, 2018, pp. 1-6.
- mixture Gaussian M. Wahbah, **O. Alhussein**, et al., "Evaluation of parametric statistical models for wind speed probability density estimation," in IEEE Proc. EPEC, 2018, pp. 1-6.
- SDN, space-air-ground N. Zhang, S. Zhang, P. Yang, **O. Alhussein**, W. Zhuang, and X. Shen, "Software defined space-air-ground integrated vehicular networks: Challenges and solutions," IEEE Comm. Magazine, vol. 55, no. 7, pp. 101-109, 2017.
- impulsive noise, generalized fading **O. Alhussein**, I. Ahmed, J. Liang, S. Muhaidat. "Unified analysis of diversity reception in the presence of impulsive noise," IEEE Trans. Vehicul. Technol., vol. 66, no. 2, pp. 1408-1417, 2017.
- cooperative spectrum sensing A. Al Hammadi, **O. Alhussein**, P. C. Sofotasios, S. Muhaidat, M. Al- Qutayri, S. Al-Araji, G. K. Karagiannidis, and J. Liang, "Unified Analysis of cooperative spectrum sensing over composite and generalized fading channels," IEEE Trans. Vehicul. Techn., vol. 65, no. 9, pp. 6949-6961, 2016.
- ML O. Al-Jarrah, **O. Alhussein**, P. D. Yoo, S. Muhaidat, K. Taha, and K. Kim, "Data randomization and cluster-based partitioning for botnet intrusion detection," IEEE Tran. Cybern., vol. 46, no. 8, pp. 1796-1806, 2016.
- wireless, fading model B. Selim, **O. Alhussein**, S. Muhaidat, G. K. Karagiannidis, and J. Liang, "Modeling and analysis of wireless channels via the mixture of gaussian distribution," IEEE Trans. Vehicul. Techn., vol. 65, no. 10, pp. 8309-8321, 2016.
- ML, botnet R. Baiad, **O. Alhussein**, H. Otrok, and S. Muhaidat, "Novel cross layer detection schemes to detect blackhole attack against QoS-OLSR protocol in VANET," Vehicular Commun., vol. 5, pp. 9-17, 2016.
- Mixture gamma, diversity analysis **O. Alhussein**, A. Hammadi, P. C. Sofotasios, S. Muhaidat, J. Liang, M. Alqutayri, G. K. Karagiannidis, "Performance analysis of energy detection over mixture gamma based fading channels with diversity reception," in Proc. IEEE Wimob, 2015, pp. 399-405.
- ML F. Adly, **O. Alhussein**, P. D. Yoo, S. Muhaidat, and Y. Al-Hammadi, "Simplified subspace regression network for identification of defect patterns in semiconductor wafer maps," IEEE Trans. Ind. Informat., vol. 11, no. 6, pp. 1267-1276, 2015.
- mixture Gaussian model **O. Alhussein**, B. Selim, T. Assaf, S. Muhaidat, G. K. Karagiannidis, and J. Liang, "A generalized mixture of gaussians for fading channels," In Proc. IEEE VTC, 2015, pp. 1-6.
- spectrum sensing, fading B. Selim, **O. Alhussein**, G. K. Karagiannidis, and S. Muhaidat, "Optimal cooperative spectrum sensing over composite fading channels," in Proc. IEEE ICC, 2015, pp. 520-525.
- EM, fading **O. Alhussein**, S. Muhaidat, J. Liang, and P. D. Yoo, "A unified approach for representing wireless channels using EM-based finite mixture of gamma distributions," in Proc. Globecom Workshops, 2014, pp. 1008-1013.
- OFDM, SDR **O. Alhussein**, R. Mahmoud, K. Eledlebi, and Z. Sead, "Spectrum sensing techniques for OFDM-based cognitive radio networks," in Terena Netw. Conf., 2013, *Indexed poster*.
- ML K. Alromaithi, **O. Alhussein**, and P. D. Yoo, "An intelligent system for protein structure prediction," in Undergraduate Research Conf. Applied Comput., Zayed University, 2012, *Poster*.
- S. Azzeh, **O. Alhussain**, and S. A. Abusamra, "A mathematical model to decrease obesity in the UAE," in Proc. ASME IMECE, 2011, pp. 385-390.

Technical Skills

Sim. & Math	Tensorflow, Matlab, Mathematica, R, Prosim F32, Weka
Programming	Python, C++, Git
Networking	Mininet, Wireshark, NMAP, OpenFlow

Pedagogical Training

- May2021 - Sep2021 Passed an online course from the University of Hong Kong on the fundamentals of university teaching.
- 2019-2020 Attended six seminars at the University of Waterloo that covered various topics: (a) teaching methods, (b) effective lesson plans, (c) classroom delivery skills, (d) student's beliefs about learning, and (e) providing quality feedback.

Honors and Awards

- 2021 Awarded Outstanding Individual Award for the year 2021, Huawei Technologies Canada.
- Aug2021 Awarded Wireless Department Spotlight Award in Huawei Technologies Canada, Ottawa.
- Apr2021 Awarded Director Spotlight Award in Huawei Technologies Canada, Ottawa.
- Sep2019 Awarded University of Waterloo Graduate Scholarship (\$1500).
- Sep2019 Awarded Xuemin Shen graduate scholarship in communications (\$1000).
- May2019 Awarded University of Waterloo Graduate Scholarship (\$1500).
- Jan2016 Awarded faculty of engineering graduate scholarship, University of Waterloo (\$1500).
- Sep2015 Awarded four-year graduate fellowship that was not claimed, Simon Fraser University (\$200,000).
- Jan2014 - Aug2015 Awarded graduate fellowship, Simon Fraser University (\$6250).
- Sep2008 - Aug2013 Awarded full undergraduate scholarship, Khalifa University (\$172,822).
- May2012 Won first place at the ASME rapid design challenge, District J. Development Conference at the Lebanese American University.
- 2009-2011 Represented school at gulf/national programming contests (NPC2009, NPC2010, GPC2011).
- 2010-2010 Won first place at university competitive programming contest, Khalifa University.
- 2010-2010 Won second place at the engineering design competition, IEEE-UAE Student Day.

Service

- 2022-present Associate Editor for Peer-to-Peer Networking and Applications Springer Journal.
- 2022-2022 TPC member for Proc. IEEE VTC.
- 2018-2021 TPC member for Proc. IEEE CommNet.
- 2013-present Regular Reviewer for IEEE Commun. Lett., IEEE Tran. Veh. Techn., IEEE Proc. Globecom, & many other journals and conferences.
- 2010-2012 Vice Chair, IEEE Student Chapter, Khalifa University.
- 2010-2011 Engineering Section Editor, Student Voice Newsletter, Khalifa University.

Other Interests

- Swimming and Free-diving (Licensed AIDA-2, personal record: 3m45s static apnea).
- Traveling (mostly occasional weekend escapades, and event travels).